CLAIMS

1. Process for obtaining a composite material comprising at least one polymer matrix obtained by polymerization of a monomer referred to as a "monomer of interest" into a polymer, referred to as a "polymer of interest", in the presence of carbon nanotubes homogeneously dispersed in said polymer matrix, said process being characterized in that:

- said carbon nanotubes are used as catalysis support to bind homogeneously at the surface thereof a cocatalyst/catalyst couple so as to form a catalytic system;
- said catalytic system is rendered active for polymerization;
- polymerization of said monomer is performed at the surface of the carbon nanotubes using said active catalytic system, the polymerization being allowed to progress over time so as thus to obtain said polymer matrix around said carbon nanotubes, as the polymerization of said monomer proceeds.

2. Process according to Claim 1, characterized in that it comprises the following steps:

- preparing a suspension of carbon nanotubes in an inert solvent;
- pretreating said carbon nanotubes by adding said cocatalyst, so as to obtain a suspension of pretreated carbon nanotubes in which the cocatalyst is adsorbed onto the surface of the carbon nanotubes;
- preparing a reaction mixture from the suspension of carbon nanotubes thus pretreated, by adding the catalyst and circulating a flow of monomer in said suspension of pretreated nanotubes, so as to bring about in said

reaction mixture the polymerization of said monomer at the surface of said nanotubes and thus to form the composite material, in which said carbon nanotubes are coated with said polymer of interest;

- stopping the polymerization reaction when the polymerization in the reaction mixture has reached a rate of polymerization of between about 0.1% and about 99.9%.

3. Process according to Claim 1 or 2, characterized in that said monomer is an olefin and said polymer of interest is a polyolefin.

4. Process according to Claim 1 or 2, characterized in that said monomer of interest is selected from the group consisting of ethylene, propylene, copolymers thereof with alpha-olefins, conjugated alpha-diolefins, styrene, cycloalkenes, norbornene, norbornadiene and cyclopentadiene, and mixtures thereof.

5. Process according to Claim 3, characterized in that said polymer of interest is polyethylene.

6. Process according to any one of the preceding claims, characterized in that the cocatalyst/catalyst couple and the experimental parameters are chosen in such a way that the catalyst can be immobilized at the surface of the carbon nanotubes by means of the cocatalyst in order to thus form the catalytic system.

7. Process according to any one of the preceding claims, characterized in that the catalyst is capable of catalysing the polymerization of the monomer of interest and is selected from the group consisting of metallocenes, hindered amidoaryl chelates, hindered oxoaryl chelates, Fe (II and III) and Co (II) bis(imino)pyridines, and Brookhart

complexes based on Ni (II) and Pd (II), and mixtures thereof.

8. Process according to any one of the preceding claims, characterized in that the cocatalyst is methylaluminoxane or a chemically modified methylaluminoxane, or a mixture thereof.

9. Process according to any one of the preceding claims, characterized in that the cocatalyst/catalyst catalytic couple is the methylaluminoxane/$Cp^*_2ZrCl_2$ couple.

10. Process according to any one of the preceding claims, characterized in that the amount of catalyst is between about 10^{-6} and about 10^{-5} mol/g of carbon nanotubes.

11. Process according to any one of the preceding claims, characterized in that the amount of cocatalyst in the reaction mixture is between about 10^{-3} and about 10^{-2} mol/g of carbon nanotubes.

12. Process according to any one of the preceding claims, characterized in that the temperature of the reaction mixture is between 25° and 140°C.

13. Process according to any one of the preceding claims, characterized in that the pretreatment is performed at a temperature of between 25°C and 200°C for a time period of between 1 minute and 2 hours.

14. Process according to any one of the preceding claims, characterized in that the polymerization is performed at a pressure of between about 1 and about 3 bars of monomer.

15. Process according to any one of the preceding claims, characterized in that the polymerization is performed at a pressure of between about 1.1 and about 2.7 bars of monomer.

16. Process according to any one of the preceding claims, characterized in that, in order to prepare the reaction mixture, the catalyst is added to the suspension of pretreated carbon nanotubes before circulating the flow of monomer in said suspension.

17. Process according to any one of Claims 1 to 16, characterized in that, in order to prepare the reaction mixture, the addition of the catalyst to the suspension of pretreated carbon nanotubes and the circulation of the flow of monomer in said suspension are concomitant.

18. Process according to any one of the preceding claims, characterized in that the carbon nanotubes are selected from the group consisting of single-walled carbon nanotubes, double-walled carbon nanotubes and multi-walled carbon nanotubes, and/or mixtures thereof.

19. Process according to any one of the preceding claims, characterized in that the carbon nanotubes are crude and/or purified carbon nanotubes.

20. Process according to any one of the preceding claims, characterized in that the carbon nanotubes are functionalized carbon nanotubes.

21. Process according to any one of the preceding claims, characterized in that the polymerization reaction is stopped when the rate of polymerization is such that the composite comprises between about 50% and about 99.9% of carbon nanotubes and between about 50% and 0.1% of polymer.

22. Process according to any one of the preceding claims, characterized in that the polymerization reaction is stopped when the nanocomposite formed comprises between about 0.1% and about 50% of carbon nanotubes homogeneously dispersed at the nanoscopic scale in the polymer matrix, and between about 99.9% and 50% of polymer.

23. Process according to any one of the preceding claims, characterized in that it comprises an additional step during which the composite material is used as a masterbatch to prepare a nanocomposite based on a polymer known as an "addition polymer", said addition polymer being miscible and compatible with the polymer of interest of the composite material.

24. Catalytic system for performing the process according to any one of the preceding claims, comprising carbon nanotubes, a cocatalyst and a catalyst, said catalyst forming with said cocatalyst a catalytic couple, in which said catalyst and said cocatalyst are bound to the surface of said carbon nanotubes.

25. Composition for performing the process according to any one of the preceding claims and comprising the catalytic system according to Claim 24.

26. Composite material obtained by the process according to any one of the preceding claims.

27. Composite material according to any one of Claims 1 to 26, comprising between about 0.1% and 99.9% of carbon nanotubes and between about 99.9% and 0.1% of polymer.

28. Composite material obtained by the process according to any one of the preceding claims and corresponding to a nanocomposite comprising at least one matrix of at least one polymer, in which carbon nanotubes are homogeneously dispersed at the nanoscopic scale.

29. Composite material according to Claim 28, comprising between about 0.1% and about 50% of carbon nanotubes and between about 99.9% and about 50% of polymer.

30. Composite material according to any one of Claims 26 to 29, wherein the carbon nanotubes are coated with polymer.

31. Composite material comprising a matrix of at least one addition polymer and the composite material according to any one of Claims 26 to 30.

32. Use of the process according to any one of the preceding claims, for deaggregating carbon nanotubes.

33. Process for polymerizing a monomer, characterized in that it uses the process according to any one of the preceding claims, the polymerization reaction being allowed to proceed for a period sufficiently long so as to have a content of carbon nanotubes of less than 0.1% and a polymer content of greater than 99.9%.

34. Polymer obtained by the process according to Claim 33.

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